Problem 3.74 Find the Norton equivalent circuit at terminals (a, b) of the circuit in Fig. P3.74.

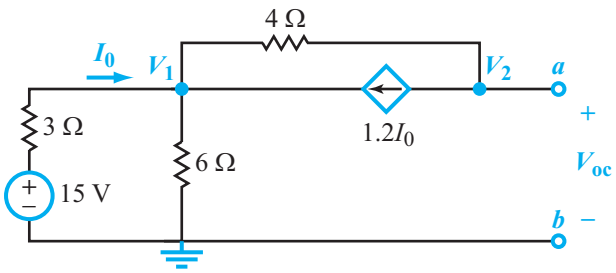


Figure P3.74: Circuit for Problems 3.74 and 3.75.

Solution:

$$\frac{V_1 - 15}{3} + \frac{V_1}{6} + \frac{V_1 - V_2}{4} - 1.2I_0 = 0$$

$$\frac{V_2 - V_1}{4} + 1.2I_0 = 0$$

Additionally,

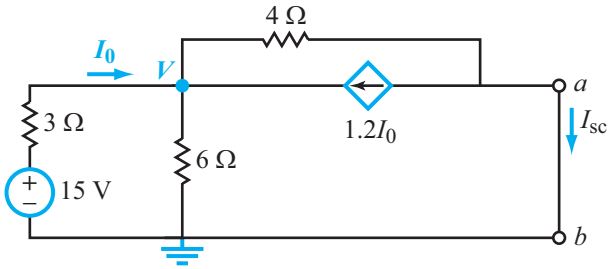
$$I_0 = \frac{15 - V_1}{3}.$$

Solution yields:

$$V_1 = 10 \text{ V}, \qquad V_2 = 2 \text{ V},$$

$$V_{\text{Th}} = V_{\text{oc}} = V_2 = 2 \text{ V}.$$

To find R_{Th}, we will calculate I_{sc}:



$$\frac{V - 15}{3} + \frac{V}{4} + \frac{V}{6} - 1.2I_0 = 0$$

$$I_0 = \frac{15 - V}{3}$$

Hence,

$$V = 9.57 \text{ V}.$$

$$I_{\text{sc}} = \frac{V}{4} - 1.2I_0 = \frac{9.57}{4} - 1.2\left(\frac{15 - 9.57}{3}\right) = 0.217 \text{ A}.$$

$$R_{\text{Th}} = \frac{V_{\text{oc}}}{I_{\text{sc}}} = \frac{2}{0.217} = 9.2 \ \Omega.$$

Hence, Norton equivalent is:

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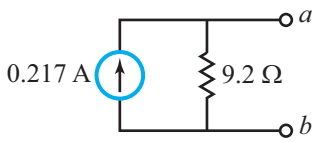

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